Course Introduction

Fundamental Accelerator Theory, Simulations and Measurement Lab

Soren Prestemon, David Robin and Fernando Sannibale
Lawrence Berkeley National Laboratory

List of Attendees

1. Jeffrey Ball , ORNL , ae
2. Hannes Bartosik , Technical University of Vienna , gs
3. Anthony Bavuso , Jefferson Lab , bsee
4. William Chase , Brookhaven National Laboratory , bsp
5. Paul Cummings , Embry-Riddle Aeronautical University , ug
6. Ekaterina Danilova , ORNL , ms
7. Laurie Elizabeth (Elisa) Dowell , Naval Research Laboratory , msrs
8. Kristine Ferrone , Brookhaven National Laboratory , bsa
9. Lynn Garren , Fermilab , phd
10. Andres Gomez Alonso , Universitat Politecnica de Catalunya & CERN , gs
11. Robert Hensley , Embry-Riddle Aeronautical University , ug
12. Lukas Jagerhofer , Technical University of Vienna , gs
13. Muhammad Jamil , Konkuk University , gs
14. Everette R. Martin , Fermilab , bsee
15. Nicola Pozzobon , University of Pisa , gs
16. Valentina Previtali , Genova University & CERN , gs
17. Molly Scannell , BNL , bs
18. Eric Tse , SLAC , bap
19. Jonah Weber , LBNL , bsee

Scope of the Course

- General overview of the particle accelerator field addressed to a very diversified audience.

- Most of the issues will be discussed in a kind of general description with special accent on the important concepts.

- Significant examples will be studied in more detail.

- The lab part requires hands on participation and will give a real feeling on common problems of accelerator physics and engineering.

- Simulations will give a taste of accelerator designing.

- All of this in two weeks !!!

- At the end of the course, survivors should have been developed the "vocabulary" required for the understanding of most of the important issues in accelerators.

Course Structure

- 9:00 am - 12:15 pm: Two 1,5 hour lectures with 15 min. break in between.
- 12:15 - 2:00 pm: Lunch interval.
- 2:00 - 5:00 pm Three hours laboratory and simulations.

- In the evening during the "homework time", instructors will be available for further discussion on course related topics.

- Final tests on Friday 27 morning (three hours) and no lab in the afternoon.

  - Soren Prestemon: 1st and 2nd week laboratory and simulations
  - David Robin: 1st week lectures
  - Fernando Sannibale: 1st and 2nd week lectures

Morning Lectures Agenda

	Monday Jan. 16	Tuesday Jan. 17	Wednesday Jan. 18	Thursday Jan. 19	Friday Jan. 20
9:00 am to 10:30 am	Presentation & Introduction S. Prestemon, D. Robin, F.Sannibale	L2: *Maxwell equations and special relativity in accelerators* D. Robin	L4: *Changing the particle energy.* F. Sannibale	L6: *Optical functions.* D. Robin	L8: *Longitudinal dynamics in storage rings.* F. Sannibale
10:45 am to 12:15 am	L1: *Historical Overview, accelerator examples and applications* D. Robin	L3: *Single particle dynamics. Matrix representation of the accelerator elements* D. Robin	L5: *Phase space representation. Ensemble of particles, emittance* F. Sannibale	L7: *Storage rings: Betatron motion, tunes and resonances.* D. Robin	Week summary and discussion S. Prestemon, D. Robin, F.Sannibale

	Monday Jan. 23	Tuesday Jan. 24	Wednesday Jan. 25	Thursday Jan. 26	Friday Jan. 27
9:00 am to 10:30 am	L9: *Particle sources* F. Sannibale	L11: *Lifetime in storage rings* F. Sannibale	L13: *Real Accelerators. Errors and diagnostics* F. Sannibale	L15: *Colliders and luminosity* F. Sannibale	Final Exam
10:45 am To 12:15 am	L10: *Injection & extraction* F. Sannibale	L12: *Collective effects. Single and multibunch instabilities* F. Sannibale	L14: *Light sources and brightness.* F. Sannibale	Week summary and discussion S. Prestemon, F.Sannibale	Final Exam

References

- The main reference is: Helmut Wiedemann, *Particle Accelerator Physics I*, Springer Editor, second edition (1998).

- The lectures does not have the same structure and organization of the main reference text book, but most of the arguments treated on the lectures are present on the main reference as well.

- Lectures viewgraphs (handouts) have been organized in the attempt of being self-explanatory, requiring minimum consultation of other references.

- Other references, when used, are specified at the end of the lectures.

Final Valuation

- Daily homework will be assigned and it is due for the next day. Collaboration between students is encouraged.

- Lab experiments will require a report for each of the two weeks.

- In a three hour final test, recapitulation problems will be assigned that must be resolved individually.

- The final grade will be defined by combining with equal weight the results obtained in the three activities above.

Good luck!!!